1. Discharge monitoring and flood mitigation in the Sihl catchment

- The Sihl river represents the largest flood threat for the city of Zurich. This risk was enhanced during the construction (2008-2011) of an underground railway station below the river bed (Fig. 1).

- A panel of experts was created to anticipate and mitigate extreme discharge events. As a first flood mitigation measure, it can make decisions on preventive controlled water releases from the Lake Sihl reservoir, which enables flood buffering (Fig. 2).

- To provide decision support, an operational hydro-meteorological ensemble prediction system (HEPS) was launched in 2008 (Fig. 3).

2. Evaluation of the operational hydrological ensemble prediction system

- In this study we investigate the HEPS suitability for the small-scale Sihl basin (336 km²) and evaluate its potential for decision support using a 31-month (June 2007 to December 2009) reforecast.

3. Comparison of deterministic and probabilistic forecasts

- Quantitative evidence of the benefits of the probabilistic approach: Brier skill scores (BSS) for COSMO-LEPS-based forecasts are higher than those achieved using COSMO-7. This is valid for all lead times and thresholds.

- Under-sampling of rare events: the size of the error bars emphasizes that the uncertainty in evaluating model performance increases significantly with event intensity.

4. Case study and scenario for the 15 August 2008 event

- We analyzed the most severe events of the period using a novel graphical representation: "continuous persistence plots" (Fig. 5a).

- COSMO-LEPS- (resp. COSMO-7-) based forecasts improved (resp. worsened) with decreasing lead times (Fig. 5). Good performance of the hydrological/hydraulic part (HREF).

5. Conclusions and outlook

- Although probabilistic forecasts do convey added-value in comparison to deterministic ones, precipitation forecasts must be improved to guarantee sufficiently early flood predictions in the Sihl catchment.

- Correct streamflow forecasts may not be sufficient for efficient flood mitigation if they are not accompanied by a dedicated tool to compare multiple mitigation actions.

- Rank histograms (not shown) reveal pronounced over-confidence in the probabilistic hydrological forecasts. Integrating more sources of uncertainty is required.

- No definitive conclusion on the model chain capacity to forecast flooding events endangering the city of Zurich could be drawn because of the under-sampling of extreme events.

- A scenario with an artificially increased Sihl Lake level (889 m a.s.l. on 15 August 2008 at 00:00 UTC) was run to induce dam overflow (Fig. 6).

- The risk of flooding of the railway construction site (i.e. exceeding 300 m³/s⁻¹) would have been correctly captured by the ensemble.

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